

**NAVAL POSTGRADUATE SCHOOL
MONTEREY, CALIFORNIA**



THESIS

**ADAPTIVE INFORMATION SYSTEMS:
PORTALS TO EMPLOYMENT, TARGETING
THE PHYSICALLY AND MENTALLY
CHALLENGED**

by

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September 1996

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TARGETING THE PHYSICALLY AND MENTALLY CHALLENGED**

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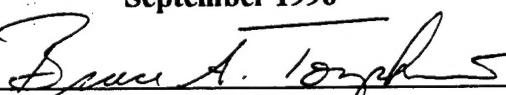
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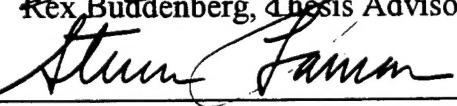
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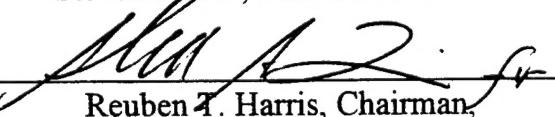
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ABSTRACT

This thesis assesses and provides a critical evaluation of reasonable accommodations in the telecommunications and information systems technologies for people with disabilities at the Naval Postgraduate School. The Americans with Disabilities Act of 1990 established a clear and comprehensive prohibition of discrimination on the basis of disability. As barriers to access are removed, more people with disabilities are taking their rightful places as contributing members of society.

This research has provided an assessment of the Naval Postgraduate School's compliance with the spirit of the Americans with Disabilities Act in providing reasonable accommodations. Areas where information systems and telecommunications products and services are not fully accessible by faculty, staff, or student with a disability were identified.

This research provided recommendations to assist NPS faculty, staff, and managers of Automated Information Systems provide Assistive Technologies Support Services and Devices. Outside resources were identified that can assist the Naval Postgraduate School by providing the expertise, education, and training on the issues dealing with reasonable accommodations in the workplace. The lessons learned are applicable to all Department of Defense activities.

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L. INTRODUCTION

Advances in technology have the potential to improve human productivity. Today, computers are helping farmers increase crop yields, helping athletes to improve their performances in the competitive arena, and allowing workers to communicate across time and space more than ever before. About 46 percent of Americans use computers at work, and more than 25 percent have computers at home [Ref. 1]. People who use computers at work earn on average 15 percent more than those that do not [Ref 2].

Advances in Information Technology (IT) are changing the way work is done, who is actually doing the work, and where the work is really being done. These technological advances are allowing the development of new products and services, and allowing them to be made less expensive than ever before. People with disabilities can use these new electronic devices to gain access to information systems and telecommunications networks to increase their individual productivity, thereby making themselves more competitive in the job market.

The practicality of many of these devices and services has increased their acceptance and popularity. Marketing researchers have realized that assistive devices for workers with disabilities can also assist workers without disabilities. Telephones with large keypads and volume controls are examples of assistive devices that are now available as standard accommodations from most manufacturers.

The application and analysis of “reasonable accommodations” for qualified individuals with a disability using telecommunications and information systems technologies at the Naval Postgraduate School (NPS) is the focus of this research.

A. THE AMERICANS WITH DISABILITIES ACT OF 1990

The Bureau of the Census reported in a 1991-1992 census that approximately 43 million Americans had one or more physical or mental disabilities [Ref 3]. That is one in six Americans who have some form of disability recognized by the federal government as a physical or mental impairment that either substantially limits one or more major life activities of an individual; has a record of such an impairment; or is being regarded as having such an impairment. The same census reported approximately 120 million people were employed in the United States, of which about 16 million had a recognized disability.

Attempts by various organized groups and the federal government to remove the barriers and end discrimination against individuals with disabilities has a long history. Less than a generation ago in the United States, the medical community recommended to parents of infants having a severe disability to institutionalize the infant for life. Today these people are able to enjoy a much fuller and longer life given the advances in medicine, new health care guidelines, and changes in people's attitudes toward the disabled.

Three major events that began early in this century, I believe, have had a significant impact on ending discrimination and empowering the disabled. The first was when all groups achieved the right to vote, and judicial and federal law began to reflect the desires of the American people. Secondly, the demand by business for motivated workers has been strong for the past decade.

Finally, the information age has brought high tech equipment that has empowered people with disabilities to effectively compete in the labor force. A network of computers, videoconferencing, personal communication devices, alternative input/output devices on

office equipment, and training employees to use the technology can accommodate the limitation of an employee with a disability, thus raising his or her productivity.

1. The Vote

Parents of disabled children, and other organized groups established a beach head in 1970 in getting all children with disabilities a proper education. Colleges, universities, and society are seeing the result of that action today with the increasing numbers of students enrolled in higher education and people entering the work force who have disabilities. These educated citizens are now educated voters.

a. *1970 Education of the Handicapped Act*

This act addressed the inadequate teaching facilities and inappropriate education programs children with disabilities were receiving in public schools in the 1960's. The intent of the act failed because funds to the individual states for improving facilities and programs were not tied to proven improvements. In 1975, Congress passed the Education for All Handicapped Children Act specifying the requirements for receiving federal funds for education.[Ref 4]

2. The Character of the American Labor Force

Beginning in the 1970's and through the 1980's there was a major shift in industry away from manufacturing and towards service industries. Massive layoffs in the blue collar labor force were seen across the country, inflation was a national concern, and people began purchasing higher quality, fuel efficient, foreign made cars. The massive layoffs in the news today tend to be among the white collar workers at corporate giants like AT&T, IBM, and Apple who frequently reengineer their processes with the latest technologies. Inflation has

been relatively low during the 1990's, and automobile production is now a multinational business.

With the younger baby boomers now in their thirties, there is a shortage of "generation X" employees being experienced in the labor force. Employers are searching frantically for employees that are educated in today's high tech environment, employees that want to work, and employees that can get the job done.

The historical employment discrimination against Americans with disabilities have kept many of them an untapped source of good workers. The unemployment rate in 1995 among the disabled was at 69 percent [Ref 5]. There are numerous public and private programs available today whose purpose is helping the disabled increase their human capital potential.

a. The Rehabilitation Act of 1973

Under this act, all government contractors and subcontractors having a contract of \$2500 or more were required to initiate affirmative action policies to hire, more fully utilize, and promote people with disabilities. Section 504 prohibited discrimination against any qualified individual with a disability in any program or activity that receives federal financial assistance. Section 504, which became effective in 1977, requires the removal of barriers that prevent people with disabilities from participating in higher education. The Rehabilitation Act was amended in 1978 extending Section 504's prohibition to discrimination to all programs and activities conducted by federal agencies. [Ref 6]

In 1986 an amendment, Section 508, emphasized the importance of Information Technology (IT) in making programs accessible. In 1992 this act was further amended with Section 509, requiring the Secretary of Education to develop and establish

accessibility guidelines for federal agencies. Individuals with disabilities are to have the same access to federal agency information and data, regardless of the medium, that are accessible to individuals without disabilities.

3. Titles of The Americans with Disabilities Act of 1990

In the two decades following the Rehabilitation Act of 1973, people with disabilities achieved major accomplishments in education and in gaining employment in the federal sector. It would prove inevitable that the barriers to employment in the private sector would be overcome as well.

The Americans with Disabilities Act (ADA), was signed July 26, 1990, by *President George Bush*. The intent was to properly align the nations goals regarding individuals with disabilities to assure equality of opportunity, full participation, independent living, and economic self-sufficiency for such individuals. The purpose of the ADA is; to mandate the elimination of discrimination against individuals with disabilities, to put forth enforceable standards, and to ensure the Federal Government plays an active role in enforcing the standards and continued identification of areas of discrimination against individuals with disabilities. [Ref 7]

Until the ADA was signed into law, very few federal laws concerning disability extended to the state and local government levels and into the private business sector. Individual states often enacted their own laws, at various times mirroring federal law to varying degrees. The ADA was written to take effect in stages, beginning on July 26, 1990, to provide time and an opportunity for the private sector to prepare. Government contractors

and subcontractors that worked under The Rehabilitation Act of 1973 had almost a score of years more experience over the vast majority of businesses in the private sector.

a. Title I Employment

This title of ADA became effective two years after it was signed into law. The Equal Employment Opportunity Commission is responsible for the issue of regulations necessary for carrying out this part. This title states, that no employer, employment agency, or labor organization:

... shall discriminate against a qualified individual with a disability because of the disability of such individual in regards to job application procedures, the hiring, advancement, or discharge of employees, employee compensation, job training, and other terms, conditions, and privileges of employment.

Section 102 defines a form of discrimination to be:

(A) not making reasonable accommodations to the known physical or mental limitations of an "otherwise qualified individual" with a disability who is an applicant or employee; (B) to deny employment opportunities if such denial is based on the need for reasonable accommodations to the physical or mental impairment of an employee or applicant.

The term, reasonable accommodation as defined by the ADA, may include:

(A) making existing facilities used by employees readily accessible to and usable by individuals with disabilities; and (B) job restructuring, part-time or modified work schedules, reassignment to a vacant position, acquisition or modification of equipment or devices, appropriate adjustment of modifications of examinations, training materials or policies, the provision of qualified readers or interpreters, and other similar accommodations for individuals with disabilities.

The ADA also provides coverage to an employer. The removal of architectural barriers and providing reasonable accommodations must be done only when it is readily achievable without significant difficulty or expense. A job description does not have

to be altered by an employer to suit the ability of a worker with a disability. A disabled applicant does not have to be hired if that applicant is not otherwise qualified for the job.

Section 102 of the ADA makes it clear that employers must make reasonable accommodations for known physical or mental limitations. This places the responsibility on the employee or job applicant to inform their employer of their disabilities.

b. *Title II Public Services*

This title, in general, became effective in January 1992, 18 months after enactment. The Secretary of Transportation is primarily responsible for issuing of regulations necessary for carrying out this part. This title states, that subject to certain provisions listed:

...no qualified individual with a disability shall, by reason of such disability, be excluded from participation in or be denied the benefits of the services, programs, or activities of a public entity, or be subjected to discrimination by any such entity.

This title guarantees that the public service is accessible, not necessarily the public building where the service originates.

c. *Title III Public Accommodations and Services Operated by Private Entities*

This title, in general, became effective in January 1992, 18 months after enactment, and the Department of Justice is responsible for the investigation of alleged violations. This title states;

No individual shall be discriminated against on the basis of disability in the full and equal enjoyment of the goods, services, facilities, privileges, advantages, or accommodations of any place of public accommodation by any person who owns, leases (or leases to), or operates a place of public accommodation.

Private firms, and others, that do business with the public must make their services available to all customers.

The courts continue to interpret the intent of this title setting new precedent. The Department of Justice has taken an approach of encouraging voluntary compliance by the business sector. The Justice Department has geared its:

... efforts toward education-providing technical assistance and information to help businesses and local governments comply with the act in easy, cost effective ways [Ref 8].

See Appendix A for a complete copy of the article on ADA by *Attorney General Janet Reno* and *Mr. Dick Thornburgh*.

d. Title IV Telecommunications

This title amended the Communications Act of 1934, and became effective on July 26, 1993, three years after the date of enactment. The Federal Communications Commission (FCC) is responsible for administering and enforcing the provisions.

Section 401 of this title called for a nationwide communication service that would be available for users with a hearing and speech impairment. The system is designed around a Telecommunications Device for the Deaf (TDD), and a Telecommunications Relay Service (TSR) provided by common carriers on both an interstate and intrastate system. Individual state public utility commissions may oversee intrastate operations. See Appendix B for additional information on the Federal Information Relay Service (FIRS) and the TSR. Section 402 set forth the requirement to use closed captioning with televised public service announcements that are produced or funded by federal agencies. Title V, Miscellaneous Provisions, amplifies responsibilities and standards of federal agencies and states.

4. Americans with Disabilities in the Information Age

The last milestone in the removal of barriers was the advent of electronic technologies with all the associated hardware and software allowing access to information and data for individuals with disabilities. This technology along with the ADA will provide many people an opportunity for greater achievements in areas where their limitations and discrimination once denied them access.

The well known physicist and author, Stephen Hawking exemplifies the use of modern technology to assist him in his daily activities. He is restricted physically and uses modern electronic technologies to maintain his ability to communicate; a major life function.

a. Technology-Related Assistance for Individuals with Disabilities Act of 1988 as Amended in 1994

This Act provides federal financial assistance to states supporting programs of technology-related assistance, information, training, and public awareness programs to all individuals with disabilities, their families, personal assistants, employers, and others. It recognizes the vast potential of modern technology to assist people with disabilities and calls for it to be used to enable them:

- (A) to have greater control over their lives;
- (B) to participate in, and contribute more fully to, activities in their home, school, and work environments, and in their communities;
- (C) to interact to a greater extent with individuals who do not have disabilities; and
- (D) to otherwise benefit from opportunities that are taken for granted by individuals who do not have disabilities.

The act defines the following two terms:

Assistive Technology Device - Any item, piece of equipment, or product system, whether acquired off the shelf, modified, or customized, that is used

to increase, maintain, or improve functional capabilities of individuals with disabilities.

Assistive Technology Service - Any service that directly assists an individual with a disability in the selection, acquisition, or use of an assistive technology device. [Ref 9]

The Rehabilitation Act's requirement, as amended in 1992, for access to data and information, coupled with this emphasis in Assistive Technology Devices and Services has allowed individuals with disabilities access to the same data, information, and services as people without disabilities. Furthermore, these relatively new technologies allow employers to provide inexpensive reasonable accommodations to workers with disabilities as required by the Americans with Disabilities Act of 1990. Accommodating a worker's limitation, resulting from a disability, increases the worker's productivity so that he/she can effectively compete in the labor force.

These three things, (the vote, the demand for good workers, and high tech equipment) I believe, have helped in ending discrimination and have empowered those with disabilities. Computers are a common sight in public schools, colleges, and universities across the country. Entire courses are being taught using computers in many different ways. The computer's compatibility with it's hardware and software accessibility present possible enhancements for students and workers with disabilities.

B. LITERATURE REVIEW

The Telecommunications Act of 1996 "supplements" the Communications Act of 1934, as amended by the ADA. "Supplements" is emphasized because the law is new and

its exact meaning in all areas has not been addressed by the Federal Communications Commission.

Section 255 of the Telecommunications Act requires that public telecommunications equipment and the public premises be accessible to and usable by individuals with disabilities; when it can be accomplished without significant difficulty or expense. The provider of telecommunications services is to ensure it is accessible to and usable by individuals with disabilities; when it can be accomplished without significant difficulty or expense. [Ref 10]

The ADA provides supplemental guidance for all federal agencies to utilize reasonable accommodations to meet the requirements of the Rehabilitation Act of 1973. The Code of Federal Regulations sets forth specific requirements for accessible telecommunications, computers, and other office equipment in all federal agencies.

In response to this guidance on using new technology in the workplace, habitation engineering is an emerging field where;

Experts analyze the specific needs of individuals with disabilities and then develop or modify fixtures and devices in the workplace to allow individuals with disabilities to function more effectively [Ref 11, p.56].

Habitation engineering should not be confused with ergonomics. Both of these will be discussed in more detail later.

In literature on employees and the workplace, I have found there are two terms that describe the same service or device, depending on whether the employee has a disability or not. For example, an employee with diabetes may need several scheduled work breaks throughout the workday to check his/her blood sugar level. This would be considered a "reasonable accommodation" for an employee with a disability. Another employee may need

adjusted work hours to pick up children from school in the afternoon. This accommodation for an employee without a disability is called "employee responsive environment."

The type and amount of training recommended for employees varies. On one end of the literature spectrum, key personnel at all levels should receive varying degrees of training in three areas [Ref 11, p 63]:

- attitude management,
- awareness of adaptive technology, and
- knowledge of collaborative partnership models.

At the other end of the spectrum, the U.S. Navy's Enlisted Personnel Management Center (EPMAC) in New Orleans maintained an average 20 percent employment rate for employees with disabilities through most of the 1980's. The director of the management services division stated, "We really have no special training of any kind [Ref 6, p.321]." I believe this may be attributed to a good employer/employee relationship. Once policies and work relationships are established they are easily maintained. Problems can get solved at the lowest level possible within the organization when decision making authority can be delegated down.

Managing Information Resources for Accessibility is an excellent middle of the road management handbook targeted to Information Resource Management (IRM) personnel and program managers. Developed by Government Services Agency's (GSA) IRM Service, the handbook provides information on accessibility, how to incorporate accessibility into agency practice, and the types of accommodations available [Ref 12]. The handbook provides information on contract specifications that would ensure a system is accessible throughout

the life of the contract. The handbook is available on the Internet or through the GSA. See Appendix C for more information on resources available on the from the GSA.

The Internet is a vast source of information on current technology, law, support groups, and education for people with disabilities. There are numerous disability related support groups and documents available from government and privately maintained online locations. See Appendix C for a list of excellent Internet web pages on disabilities and a brief explanation.

Magazines and newspapers available in most public libraries provide a wealth of current information on government and business trends on compliance with ADA. There are several good magazines, in my opinion, that specifically deal with all types of disabilities and an array of related issues. *Syllabus* is an excellent magazine that brings together the changing needs of secondary education and current developments in information systems and telecommunications technology. *The Wall Street Journal* is an excellent resource for staying abreast of changes in law, developments in the workplace, and trends in all types of technology.

The Dudley Knox Library at the Naval Postgraduate School, receives several excellent federal publications that provide information on various disabilities. The U.S. Department of Commerce for example, maintains a National Technical Information Service (NTIS) that publishes a free catalog on the products and services provided. A 1995-1996 NTIS Catalog of Products and Services can be requested by calling (703) 487-4650.

Equal Access to Software and Information (EASI), an affiliate of the *American Association for Higher Education*, has developed several excellent online workshops that

focus on assistive computing technology, service requirements and cognitive tools for educators. EASI has also taken the lead in assisting colleges and universities by providing a benchmark approach in implementing assistive computing services. There is no proven method or panacea for colleges and universities to ensure computer and other electronic resources are totally accessible to all people. Consultants boastfully advertise their wares and expertise for a price. EASI's "Adaptive Computing Technology Background Checklist" provides the closest resemblance to a "reasonable accommodations standard" for colleges and universities to evaluate by themselves, at reasonable expense, the accessibility of their own computing services. See Appendix D for more information on EASI.

Today's frugal office and AIS managers need to find a cost effective method to get the customer or employee the right accommodation. Research at the *Job Accommodation Network* (JAN) reveals that 68 percent of accommodations made by employers costs less than \$500 to implement. JAN provides free accommodation consulting services to businesses, rehabilitation professionals, and individuals that call. See Appendix E for additional facts and information on JAN and other related information resources. A valuable resource that is linked to JAN's web page is titled "Communicating With and About People with Disabilities." See Appendix F for a copy of this document.

There are also numerous local area resources available in Monterey. I found area businesses eager to share information, actively seeking interviews, and involved in support groups and other available resources. The Human Resources Administrator at *Embassy Suites* in Monterey, California was very knowledgeable and helpful in explaining how their program for employees and customers with disabilities was developed by a consultant.

Monterey Peninsula College (MPC) maintains an excellent faculty and staff that are able to assist students with all types of physical and learning disabilities. MPC maintains a computer lab dedicated to teaching computer applications and providing the electronic resources for students with disabilities.

C. RESEARCH METHODOLOGY

The research methodology relied on a review of literature on reasonable accommodations in computer and telecommunications products and services, an evaluation of actions taken by civilian universities and businesses to remove barriers to their computer and telecommunications products and services, and consultation with experts in assistive technology and support services.

The primary research questions are:

- What can the NPS do now, in the Information Age, to ensure it is in compliance with the spirit of providing reasonable accommodations in computer and telecommunications products and services, for an employee or student with disabilities as required by the Americans with Disabilities Act, Public Law, and Federal Regulation?
- What types of reasonable accommodations are needed at NPS?
 - a. What kind of assistive technology can be used?
 - b. What kind of support services can be used?
- What innovative changes in adaptive computing technology devices and assistive support services are being made in public and in private businesses?

- What companies, organizations, and government resources are available to assist the Naval Postgraduate School in complying with the spirit of reasonable accommodations in adaptive computing technology devices and assistive support services?

The answers to these questions will provide an assessment of the Naval Postgraduate School's capability to provide reasonable accommodations for faculty, staff and student with disabilities, in the areas of computer and telecommunications products and services, as required by the Americans with Disabilities Act, Public Laws and Federal Regulations. This research will also provide recommendations to the Naval Postgraduate School staff that will help them meet the assistive technologies and support services requirements for an employee or student with disabilities. Areas where information systems and telecommunications technologies are not fully accessible by people with disabilities will be identified.

II. THE DEPARTMENT OF DEFENSE AND THE AMERICANS WITH DISABILITIES ACT

The Department of Defense (DoD) is required by law to establish a program that will facilitate the hiring, placement, and advancement of employees with a disability. DoD maintains it is the applicant's/employee's responsibility to inform the Equal Employment Opportunity Office (EEOO), or the employee's supervisor, of his or her disability. It is also the individual's right not to divulge such information.

An employee may make known to DoD their disability by completing Standard Form 256, SELF-IDENTIFICATION OF HANDICAP. This form can be obtained from the EEOO. This DoD disability reporting system is maintained by EEOO, and is strictly voluntary, except in a few instances where it is required by law.

Managers of DoD Automated Information Systems (AIS) should be involved in the creation and the updating of job descriptions, interviewing job applicants, and personnel training requirements. The Human Resources and Equal Employment Opportunity Representatives should be consulted regularly by managers for assistance in their department's civilian personnel requirements.

The Human Resources Office (HRO) should also be well versed in the requirements of a vacant position. Here, the job description provides the employment office the exact requirements of a vacant position.

Managers must ensure access to all office equipment for employees with disabilities as required by the Code of Federal Regulations. These federal regulations require all agencies to identify computer and telecommunication accessibility requirements for current and

prospective employees and for public information services. These requirements should be addressed up front in solicitation documents and when subscribing to telecommunications services.

Managers need to stay current with changes in federal and state law. A few states have additional laws dealing with employment where federal installations in these states will want to comply. Federal Regulations require that public entities provide telephone emergency service, including 9-1-1 services, be accessible to persons with impaired hearing and speech through telecommunications technology.

The [California] Department of General Services collects 9-1-1 surcharges from phone customers and is one of only a few states that provides statewide funding for local 9-1-1 [TDD] equipment [Ref 13].

There are differences in federal regulations also. The ADA and the Veterans Administration (VA) have different definitions for the term "disability." To qualify as disabled by the VA may not necessarily meet the requirements of the ADA, and vice versa. Personal assistive devices, such as eye glasses and hearing aids, are not included as an Assistive Technology Device as defined by ADA [Ref 14]. Additionally, there are numerous facts and figures that are not well known, such as, about one in ten visually impaired people read braille [Ref 15]. The Human Resources Office will have some of the latest general information available for managers.

DoD's goal is to have individuals with disabilities represent two percent of its civilian work force. When an applicant with a disability, who is otherwise qualified, is considered for a position using an Automated Information System, reasonable accommodations for the limitation must be made; it's the law. The AIS manager, Office manager, HRO

representative, a Disabilities Committee Member, and the job candidate should all be involved in various degrees in the selection of the right type of accommodation.

Each person and every disability is different. The individual with a disability must be evaluated to determine their unique requirements for accommodating their limitation. The employee, or job applicant will most likely be able to offer the best approach. Only after the limitation has been accommodated can an evaluation of the individual's ability in that capacity be assessed. It is important to remember this point,

Employees don't have to accommodate a disability. What they accommodate is the limitation caused by the disability [Ref 11, p. 58].

Office and AIS Managers need to be aware of special computer interface requirements for current or prospective disabled employees. Assistive software compatibility with the operating system, and other applications on the server, will need to be addressed. Windows applications are sometimes difficult to use by people who are visually impaired and require a screen reading device. A different person with a disability may find windows applications very efficient and easy to use. For example, the three print options available on some windows applications offer a large degree of flexibility; two methods using a mouse, the print icon on the tool bar or from the "FILE" drop-down menu, and from the keyboard "CONTROL + P."

Special input/output devices may be required, such as, screen readers, -screen enhancers, sip and puff systems, Telephone Devices for the Deaf (TDD), and braille printers. The AIS should be designed from the beginning to easily accept these types of hardware

devices or software applications. See Appendix C for the location of GSA's IRM Service Handbook web site.

Telephone systems can be easily configured for a Telephone Device for the Deaf or multiple line telephones can be altered so that different lines ring with a different tone. Also of concern, are special requirements for physical space and adjustable furniture for access with a wheelchair. The Program Manager and the IRM Organization must provide the Contracting Officer with these types of AIS requirements. Vendors should be required to demonstrate the use of some of these devices before the Program Manager accepts the system.

In October 1990 the Department of Defense established the Computer/Electronic Accommodation Program (CAP) to assist DoD activities in selecting and procuring adaptive equipment and services to provide access to telecommunications systems, computers, and other office equipment. This Program was established under the Defense Medical Information Management Office in the Office of the Secretary of Defense. An additional office conveniently located in the Pentagon is staffed by personnel familiar with assistive technologies and services. Along with the hardware and software, CAP will cover many of the training and service costs associated with making Automated Information Systems accessible for DoD employees or students with disabilities. See Appendix G for additional information on CAP's resources.

CAP does not have a services evaluation checklist such as the Adaptive Computing Evaluation Kit recommended by EASI. CAP does not provide a management handbook like *Managing Information Resources for Accessibility*, developed by the GSA's IRM Service.

On average, new technology assistive devices are relatively more expensive than other electronic equipment. A small market demand has meant that most assistive technology is available only via mail order. The CAP Office can provide NPS the resources to assist employees and students with a disability in a timely and cost effective manner.

A. REASONABLE ACCOMMODATIONS AT THE NAVAL POSTGRADUATE SCHOOL

HRO reports that civilian employees with a disability represent approximately 13.6 percent of NPS's work force [Ref 16]. This is well above the Department of Defense's established goal of two percent.

Reasonable accommodations are managed by the EEOO Counselor/Accommodations Coordinator. Accommodations can be made in either the workplace or at some other site under the "Federal Flexible Workplace Pilot Project" (Flexiplace).

Flexiplace is a project sponsored by the President's Council on Management Improvement and co-directed by the U.S. Office of Personnel Management (OPM) and the GSA. Flexiplace consists of three basic components:

- Work-at-home program;
- Satellite workcenter program; and
- Flexiplace accommodations for disabled workers.

An individual with a disability may feel the need for an accommodation of their limitation to effectively compete for employment at NPS, to get a different job or promotion, or they feel an accommodation would relieve some discomfort. A job applicant/employee voluntary identifies themselves as having a disability and requests an accommodation for their

limitation. The individual should then be prepared to offer suggestions as to what type of reasonable accommodation would work best for them. Their supervisor, an HRO Representative, or a member of the Disability Program Committee will be involved in the evaluation of an employee's request.

A DoD employee need not have a disability recognized by the ADA to request an evaluation of their workplace by an ergonomics facilitator, or to receive an accommodation for the relief of discomfort in the workplace. These requests are handled, similar to other requests, by the employee's supervisor and/or an HRO Representative.

NPS's Ergonomics Program Manager is available to analyze an employee's work environment and provide recommendations for controlling ergonomic hazards. Not all discomfort is related to a disability, nor do all disabilities cause discomfort. The most common computer related health problem is eye strain, followed by a repetitive stress injury related to keyboard use that is specifically known as Carpal Tunnel Syndrome.

Office managers and AIS managers in general, are not qualified to make a proper diagnosis of a disability. An employee may therefore be required to provide proof of a disability from a physician, social worker, or other qualified professional when a service is initially requested.

The EEOO Accommodations Coordinator can assist an employee or job applicant by recommending and obtaining the services of the appropriate professional for a diagnosis; for example: to treat back pain a physical therapist might be recommended; to identify a possible learning disability, an educational therapist might be considered; or to obtain an Assistive Technology Device, a habitation engineer may be required.

B. ASSISTIVE TECHNOLOGY DEVICES AVAILABLE AT THE NAVAL POSTGRADUATE SCHOOL

The Technology-Related Assistance for Individuals with Disabilities Act of 1988 as

Amended in 1994 defines, Assistive Technology Device as;

Any item, piece of equipment, or product system, whether acquired off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities.

The prevailing assistive technology devices identified at NPS are specialized keyboards, orthopedic chairs, and other ergonomically designed furniture that are available to faculty, staff and in some student computer facilities. Just as important in assistive technology, are the distributed computing systems that allow for the sharing of printers, servers, modems, and fax machines. Computer networks and telecommunications systems are universally recognized as being able to improve the productivity of many different users in many different occupations. The client-server networks available at NPS provide access to information and data by all authorized faculty, staff, and students from many different locations. The networks can be configured with Assistive Technology Devices to accommodate the needs of those with a disability.

Assisitive Technology Devices are not restricted to only hardware. Software in computer and telecommunications can easily be employed with many different functionalities. Software can enable users to shift from a right hand to a left hand mouse. Users can change character font size by using different monitors, many different applications allow the user to change font size, or a screen enhancer placed over the monitor's screen which can significantly enlarge characters. Some of the newer software packages sold with personal

computers (PC's) have a special icon available that allows the user to easily make personal choices on various operating parameters.

E-mail is available to most faculty, office staff, and students at NPS. It is considered a convenient and reliable way to converse, send information and attached files, and conduct administrative office business. E-mail can be just as convenient for individuals who are restricted physically, verbally or hearing impaired, and with a screen reader visually impaired users may also find E-mail useful.

Most of the purchases for Assistive Technology Devices, specialized keyboards, orthopedic chairs, and other ergonomically designed furniture have been bought by the responsible department at NPS. Some requirements have been obtained by the HRO, and some employees have brought in their own. The users of these devices required no special training with the device. According to the literature reasonable accommodations in the workplace, most accommodations are this easy and relatively inexpensive.

There are some types of accommodations that could prove harder to implement; possibly requiring assistance of systems administrators and support staff along with a purchase of various hardware and software items. Each person with a disability has a unique limitation that needs to be accommodated. The accommodation has to be cost effective or it will not get implemented, it must be efficient or it will not be used, and it has to be reliable or it will not be needed. Habitation engineers can assist those employees and job applicants with disabilities with the proper Assistive Technology Service to obtain the best Assistive Technology Device.

C. ASSISTIVE TECHNOLOGY SERVICES AVAILABLE AT THE NAVAL POSTGRADUATE SCHOOL

We are referred back to the Technology-Related Assistance for Individuals with Disabilities Act of 1988 as Amended in 1994 for a definition:

Assistive Technology Service - Any service that directly assists an individual with a disability in the selection, acquisition, or use of an assistive technology device. Such services includes:

- (A) the evaluation of the needs of an individual with a disability, including a functional evaluation of the individual in the individual's customary environment;
- (B) purchasing, leasing, or otherwise providing for the acquisition of assistive technology devices by individuals with disabilities;
- (C) selecting, designing, fitting, customizing, adapting, applying, maintaining, repairing, or replacing of assistive technology devices;
- (D) coordinating and using other therapies, interventions, or services with assistive technology devices, such as those associated with existing education and rehabilitation plans and programs;
- (D) training or technical assistance for an individual with disabilities, or, where appropriate, the family of an individual with disabilities; and
- (E) training or technical assistance for professionals (including individuals providing education and rehabilitation services), employers, or other individuals who provide services to, employ, or are otherwise substantially involved in the major life functions of individual with disabilities.

The responsibility for these listed services, and the coordination of them, are not the sole responsibility of one individual at NPS; but are effectively accomplished in various degrees by the Human Resources Office, the Disabilities Committee, and the individual departments. One individual employed solely in the field of habitation engineering would possibly, in my opinion, be under-employed at NPS on a year-round basis.

The type and amount of Assistive Technology Service requested for a particular person with a disability may vary between an employee and a student at NPS. The Assistive Technology Service needed by an employee could be expected to remain constant. A student,

on the other hand, may require various services where course requirements change every quarter.

The student's curriculum office would need to assess the student's academic requirements in information systems and telecommunications access. An example would be, a specific application on a specific network is used for a required course in database development. How could a student who is visually impaired have access to this information system? Obviously, the curriculum office would need to get the right people involved with the student from the very beginning.

NPS sponsors a Special Emphasis Program, the Disabled Employment Program, that promotes the awareness and education of all employees on disability related issues and assists them in various ways. The Wellness Program promotes an atmosphere of good health for all civilians through physical and mental exercises. While injuries are not themselves a disability, good physical and mental health can prevent disabling injuries and conditions. An active safety program at NPS promotes safety for all hands at work, at home, and while enjoying recreation.

III. COMMUNICATING WITH PEOPLE WITH DISABILITIES

While assisting a college student with a disability in learning about personal computers and networking, I became intrigued with the potential for assistive devices and services to employ people with disabilities. Working with my subject for over a year, I gained personal insight into some of the possible uses of electronic technologies; and an understanding of the types of barriers, setbacks, and achievements experienced by people with disabilities in mastering the telephone, personal computer, and cyberspace.

Alexandre Dumas wrote the following scene in *The Count of Monte Cristo*. Valentine, the granddaughter of Monsieur Noirtier, who was left a quadriplegic and nonverbal after a stroke, was explaining to a notary how her grandfather would convey how his will was to be written.

The language I speak with my grandfather, monsieur, said she, is easily learnt, and in a very few minutes I can teach you to understand it almost as well as I do myself. By the help of two signs, you can be absolutely certain that my grandfather is still in full possession of all his mental faculties. Being deprived of power of speech and motion, Monsieur Noirtier closes his eyes when he wishes to signify "yes," and blinks when he means "no." You now know quite enough to enable you to converse with Monsieur Noirtier; try. [Ref 17]

Without having received exposure to the types of problems encountered by people with disabilities in accessing information systems, I believe that I could not have conducted honest research.

A. LIMITATIONS IN COMMUNICATING

My subject is nonverbal, a quadriplegic, and lives with her parents, who are both in their 70's. The stories they conveyed to me on the various obstacles and triumphs their family

has encountered have been an invaluable inspiration for me. This same technique described by *Alexandre Dumas* over 150 years ago is still being used today.

Working with my subject over the past year we had the opportunity to try several different Assistive Technology Devices. Initially, she had learned to use Character User Interface (CUI) applications, such as *Word Perfect 5.1* on her PC. The Assistive Technology Devices she required were a special input device that she controlled by applying pressure with her cheek, and a special software program that allowed her to select characters to build words. She received most of the required training at the Monterey Peninsula College where there is a student computer facility designated to teach students with disabilities.

During the transition to Graphic User Interface (GUI) based applications she encountered several obstacles. She had purchased a relatively expensive head mouse that allowed for easier movement of the cursor. The device tracked the movement of the head by reflecting infrared light off a metallic reflector worn on her eyeglasses. The software for the device moved the cursor on the screen according to the movement of her head. Once the software parameters were set, she could select options on the monitor by positioning the cursor on an object for a couple of seconds. Initially there was also a software compatibility problem with several different assistive applications running simultaneously. For my subject the new head mouse has become the preferred method of selection and data input.

While learning to use the GUI based applications along with the new head mouse, there was a lengthy learning period where her productivity was well below that experienced on the CUI based applications. This is an expected hurdle that everyone experiences to various degrees. I believe her effort to learn and use GUI based application was a worthy

investment. Physical control of the cursor's movement was also cumbersome initially with the new head mouse due to her physical limitation. Practice with the new device was the only way to improve.

Windows based applications can be inaccessible to people who are blind, visually impaired, or dyslexic. Before graphics became so widely used on the Internet information stored as characters were accessible with a screen reader. Graphics on the web is often an installed barrier for people unable to read. The solution is relatively inexpensive requiring a little extra time from the programmer to document the graphics used on a web page or in any windows based application.

The PC can accomplish many different functions that depend on the software installed and hardware connected to it. Today's PC can be used as a facsimile machine, used to manipulate other electronic devices such as dialing and answering phones, used as a TDD, and it can be used by nonverbal people to communicate verbally with the aid of a screen reader.

Verbal conversations between my subject and myself were difficult for us at first. Using her computer and a screen reader it could take up to three minutes for her to construct a reply. During the pause I would forget the conversation we were having. With her patience and help, we soon learned to effectively communicate verbally with one another.

With the use of her head mouse and a software application on her home computer she can dial the telephone. She can construct her sentences before dialing to save time once connected on the telephone. With her screen reader she can speak to the person at the other end. If she has problems contacting or communicating with the other party she could utilize the California Telecommunication Relay Service (TSR).

After much trial and error she eventually made it onto the Internet. When we communicate via E-mail there is no difference between the mail I receive from her and anybody else. Nobody else needs to be involved in the drafting, editing, and posting of her E-mail. E-mail can definitely level the playing field at work for employees with disabilities where they are able to use it.

B. COMMUNICATING IN THE FUTURE

The Information Age and the competition influenced by Telecommunications Act of 1996 holds many new Assistive Technology Services and Devices to be designed and produced. The telephone is currently in 98 percent of the homes, and more than 25 percent of the homes in the U.S. have computers. Interactive television also promises to offer many more ways to bring entertainment and information into the home.

A large amount of bandwidth associated with a service like Integrated Services Digital Network (ISDN) connected to the home is currently available from some local telephone companies. This relatively expensive service is able to transmit voice, data, and video at the same time. New technologies will continue to lower the costs of these proven technologies allowing for more users. The average American home in the near future will have more bandwidth access to the Internet or some sort of information service. Commercial companies will then be able to provide subscribers access to the future's services.

Currently the most convenient way to hold a telephone conversation is via the local loop. Most everyone is reachable via the phone at home, at work, or on the go with cellular phone technology. The Internet can also transport verbal communications, but both parties need the required software applications along with access to the Internet. Commercial

companies are investigating the technology that will make the Internet accessible from any location via low earth orbit satellites. In the future the most convenient way to hold a conversation with a distant party may not be via a telephone as we know it.

The laws and policies that require financial resources to be devoted to particular public service system have an opportunity cost that affects everyone. The Federal Information Relay System (FIRS) and the state run relay systems for example require a substantial budget to operate. They are funded by tax dollars or surcharges on a subscriber's phone bill. These services lock users into a system based on telephone technology.

Users with a personal computer, the right software, and a subscription to a wide bandwidth system can have the very same conversation plus more, than if they were connected only via a voice telephone relay system. I do not expect the convenience and utility of the telephone system to be replaced by another technology in the near future.

There is more at stake in the future's communications systems for people with disabilities than just budgets for the systems and their opportunity costs. Before corporate America can be expected to provide a new service there must be some profit margin. Outdated services that are funded by tax dollars or surcharges may not be the most convenient or preferred method of communicating in the future by people with disabilities. There are also social issues that must be addressed. When people with disabilities have subscriptions to information networks that allow them to work and do personal transactions from home such as banking, is society again institutionalizing the disabled in their own home?

The Technology-Related Assistance for Individuals with Disabilities Act recognizes the vast potential of modern technology to assist people with disabilities. The act calls for

technology to assist people with disabilities to interact to a greater extent with individuals who do not have disabilities. I believe that wide band services modified to accommodate the limitations of people with disabilities are needed to allow them to collaborate with distant parties. I also believe that society should not forget that humans have social responsibilities where we need the physical presence of friends.

IV. AN ASSESSMENT ON COMPLIANCE WITH THE AMERICANS WITH DISABILITIES ACT

Access for people with disabilities is a concern for all office and AIS managers.

Todays responsible managers are in search of the right fix that provides the best access for the most people. At the same time these managers also are concerned with maintaining the quality and quantity of their product or service.

Access specifically to information systems and telecommunications resources are a relatively newer concern for management as these laws and regulation are still in their infancy. The exact meaning, the requirements, or the intent of these new laws and regulations are still being defined in the judicial system. The technology allowing for computer and telephone access is constantly being developed. It has only been 10 or 15 years since the *IBM Selectric II Typewriter* was the workhorse of office productivity.

Because of this, many businesses are turning to outside consultant services for the right answers. Government centers and many large businesses have a designated support staff, Equal Employment Opportunity and Human Resources Offices, that provide the policy input, training, and monitor the performance on various civil right issues.

The Equal Employment Opportunity and Human Resources Offices, the Disabilities Committee Members, and Public Works at NPS are doing an outstanding job. Reasonable accommodations for access to the information systems here at NPS reflect, in my opinion, the highest standards for all faculty, staff, and in the new Mechanical Engineering Building's student computer facility. Ergonomically designed office furniture is provided for individuals

that request it, and the office furniture arrangement is easily controlled by the user as his/her needs dictate.

Physical access to some student computing facilities is restricted by outdated architectural design and furnishings. The older facilities have evolved over time with concern only for having the latest hardware and software and little regard for physical access by users with disabilities. There are plans underway at NPS to renovate the older building that would bring the architectural standards up-to-date. With a majority of the students at NPS being military, it is my opinion that there has been little or no demand from students with a disability for an accommodation.

A. AN ANALYSIS OF PROBLEMS

The problems experienced with reasonable accommodation at NPS are the same ones being addressed across the country at universities and colleges, in government centers, and businesses alike. Management's budget seems to be the biggest limitation discussed in the literature. Another significant problem is the misinterpretation of the ADA's requirements. The "sea-lawyer" can be found most anywhere to help confuse any issue. The solutions to the organization's problems can be costly; and will be compounded if they are not the right solutions, or if they are not properly implemented by management.

Section 102 of the ADA and DoD employment policies both place an emphasis on it being the applicant's/employee's responsibility to inform an employer of his or her disability. This policy, I feel, may lull some managers into a passive posture in providing accommodations. Management that waits until the requirement for an accommodations presents itself may become desensitized to the spirit of the ADA. Management is always

reacting to the next employee's new requirement for an accommodation; vice seeing the "big picture" and taking a proactive posture. Businesses operating in a capitalist market with a "wait till it comes up" policy would never have any good ideas of their own or introduce any new goods or services on their own initiative.

The single most important reasonable accommodation that must be planned for at NPS is providing physical access to all student computing facilities. Several computing facilities in Ingersoll Hall have a cipher door lock and a door handle requiring two hands to operate, thus making it difficult for some individuals with physical limitations. There is very limited personal space for users and inadequate distance between rows for an individual using a wheelchair. The student computer facilities are crammed into some of the smallest rooms in the building. Once access is provided to the facility, only a small percentage of the computers actually need to be accessible to users with a disability.

Newer architectural standards found in Glasgow Hall allow for relatively easier access at the door, more personal space for users, but still none of the furnishings are designed for students with disabilities. In my opinion, and as can be expected, the new Mechanical Engineering Building has the best access to student computer facilities. The door to the room can be easily opened with a door handle vice a door knob. The desks allow for adjustable keyboard height, and the individual's physical space is large compared to some of the other student computer facilities.

The newest computer facility in Ingersoll Hall is being set up this summer with some of the same outdated standards for physical access found in the other facilities in the building. The Federal and State laws and regulations require access for all people. The manager's

concern is what laws, regulations, and standards there are, and where can they be found? Of more immediate concern for NPS; What must be done now, in the Information Age, to ensure NPS is in compliance with the spirit of providing reasonable accommodations for an employee or student with disabilities?

B. SOLUTION

These questions have been identified and answered by several professional groups that deal in disability related issues. I recommend that NPS implement a tailored version of the "Adaptive Computing Evaluation Kit" developed by *Equal Access to Software and Information (EASI)*. The problems in accessibility need to be identified, but do not need to be fixed immediately.

The designers of EASI's evaluation kit, as well as other resources, are experienced in the issues on accessibility and are dedicated to assisting higher education institutions in developing computer support services for people with disabilities. A self evaluation of all information systems and telecommunication services at NPS would identify problem areas across the entire command. See Appendix D for additional information on the self evaluation kit, workshops, and seminars offered by EASI.

I believe that to have NPS faculty and staff attend some EASI's seminars in legal issues, computer access strategies, and accessible lab environments would prove to be a valuable asset. It could assist the designers of information systems in making facilities that are accessible to all people.

My recommendation for completing EASI's self-evaluation kit is to use a Process Action Team. The team would be chaired by a faculty member, with an HRO staff member

for continuity, and students that would be responsible for collecting and processing the data and providing a final evaluation. The final evaluation report could be a student thesis. A public works representative might be required occasionally to address problems that may generate work requests. The team's faculty and HRO members would determine which workshops and seminars to request and who should attend. The problems that I outlined above may not prove to be totally correct once a comprehensive evaluation of NPS's facilities is completed.

V. EVALUATION

The three primary outside resources that are available to assist NPS in complying with the spirit of the ADA are CAP, GSA, and EASI. Each of these organizations has a unique service to offer. CAP's emphasis is on supporting the DoD needs and providing the employee with a disability the right accommodation. GSA's services are similar to CAP's with an added emphasis on management and acquisition of accessible information systems. Following the GSA's guidelines, federal agencies are leading the demand for accessible systems by requiring programmers to design accessibility into their programs, and vendors to provide networks that are compatible with Assistive Technology Support Services and Devices. EASI's resources emphasizes the environment of accessible computer facilities at institutions of higher education.

A. RECOMMENDATIONS

A proactive posture at NPS would include as a minimum these two actions:

- Designate a Process Action Team to perform a baseline evaluation of NPS's current information systems and telecommunication facilities and determine the requirements for future levels of accessibility.
- Aggressively advertise NPS as DoD's leader in providing assistive technologies and research.

My recommendation for completing the first action above is for a PAT team to use EASI's resources to accomplish a self-evaluation. I covered the actions of the PAT team more thoroughly in the previous chapter.

Utilization and an endorsement on EASI's services to complete a baseline evaluation would have three immediate benefits for NPS. First is that EASI has the expertise in computer access issues at institutions of higher education. Secondly, the formation of an alliance with other institutions of higher education that are currently leaders in disability issues. And lastly but possibly most important is, it would strengthen NPS's position as the DoD University by being DoD's leader in reasonable accommodations and assistive technology research.

Once the baseline is established, future accessibility requirements could be focused on by the PAT team. The same Process Action Team that accomplished the self-evaluation baseline should maintain responsibility for visitor conference centers and student computer facilities. This would give the PAT team facilities to experiment with new technologies for future accommodations research.

An aggressive advertisement campaign should be launched by NPS that would create a demand for the Assistive Technology Services available, and the exciting human health research being conducted by faculty and students at NPS. For instance, the Public Affairs Office should advertise in various publications some of the research currently going on at NPS in Sudden Infant Death Syndrome (SIDS) being conducted by a Computer Science Department faculty member and student, or on spin-off technology in robotics research that could possibly be applied to prosthesis development. See Appendix H for an excellent example of how the U.S. Air Force's Armstrong Laboratories is aggressively advertising itself and promoting the value of technology they develop to people with disabilities.

Another good reason to advertise NPS as DoD's leader in accessibility is for the demand it will create for assistance from other DoD AIS managers and individuals with disabilities. No other DoD command has advertised itself as the leader in reasonable accommodations and research. NPS could easily carve this niche out assuming the leadership role and becoming the west coast CAP Office with a branch office in the Pentagon. With extra funding from the Defense Medical Information Management Office a full time habitation engineer could be hired to cover all DoD commands west of the Mississippi River. See Appendix I for an excellent newspaper article on how advertising that targets people with disabilities can help business.

More subtle methods of advertising should also be used. NPS should include information in the Pacific Bell and DoD phone books on how to contact various parties at NPS using a Telephone Device for the Deaf (TDD) or a facsimile (fax) machine. If NPS does not have a staff member able to operate a TDD, then a phone number to the California Telephone Relay Service or the Federal Information Relay Service could be listed; refer back to Appendix B. Other federal agencies are providing this kind of additional information in their telephone book listing and on web pages for people with disabilities . These are some of the ideas for future requirements that a PAT team could work on.

Learning disabilities are currently the fastest growing disability recognized by the Federal government. It has nearly tripled in the 16 years following the passage of the Education for All Handicapped Children Act in 1975 [Ref 18]. The number of individuals with a disability in higher education and in the workforce can be expected to increase; simply

because the number of both old and young Americans with a recognized disability is increasing.

The trend for using more computers in all levels of education and in most every occupation is also increasing. In the process of reengineering and downsizing of business and government centers, computers are performing more of the tasks. There is an opportunity here that can be researched and exploited by NPS. The use of Assistive Technology AIS as portals to employ people with disabilities.

The possibilities of assistive technologies are limited only because the ideas have not been thought of yet. New technologies could possibly prove more cost effective and be more efficient than renovating Ingersoll Hall. A wireless Local Area Network (LAN) in Ingersoll Hall would provide access to everyone with a compatible laptop computer from any room in the building. Any classroom in Ingersoll Hall could then dual as a student computer facility. A LAN with an relatively inexpensive modem is accessible from any other location with a telephone connection.

Distance learning courses offer many of the same benefits as telecommuting to work does. Both require the same basic equipment that can be accessed by people with or without a disability. Integrated Services Digital Networks (ISDN) provide enough bandwidth to carry voice, data, and video at the same time. Users could teleconference across the NPS network, or even from home as more workers take advantage of the Flexiplace program and telecommute from home. The growing competition in the telecommunications market should introduce many new services to the public. How this new technology in the offing gets used, the way it can change how work will be done, or how it makes information and

telecommunications more accessible to everyone is an exciting opportunity to be exploited by those individuals that know no limits.

B. LESSONS LEARNED

All shore commands with civilian employees would benefit from a self-evaluation of their information system and telecommunications facilities. The resources of an installation's local library and the Internet employment resources listed in Appendix E are of value to all HRO Representatives dealing with disability issues.

DoD installations need to include as a minimum the resources of CAP and the GSA as part of their civilian personnel training programs to ensure they continue to comply with federal directives and the spirit of the ADA. Along with employees with disabilities the command will also benefit by not excluding talented, industrious, and competent people from their employment ranks.

The less distinction there is between services offered to employees with disabilities and those offered to all employees, the more like the service is to be used. Flexiplace is a good example. It is available to all employees where possible. All people look for those organizations to work for, or places to patronize where they feel comfortable.

There are three methods used to increase human productivity:

- introduce a new technology,
- invest in personnel education,
- and by allowing individuals to master an activity thus maximizing their learning curve.

The first way, to introduce a new technology, is the most common method talked about in today's high tech environment where hardware becomes obsolete in 18 to 24 months.

New technology can be directly controlled by the command that bought it. The other two methods become part of the individual's education and training, and can not be directly controlled by the command. It is these last two methods, that I believe when properly managed by the command, can be the most beneficial to those employees with a disability.

VI. CONCLUSION

Technology improves everyone's standard of living. For people with disabilities new technologies are providing them with opportunities they were once unable to accomplish. New technologies are allowing people with disabilities to communicate with other people both near and far by accommodating their limitations. New technologies are increasing the human capital potential of people with disabilities enabling them to effectively compete in the labor force.

This thesis (written on paper) is inaccessible to the millions of people that are visually impaired, physically unable to hold a book, or unable to turn the page. This same thesis written as a file stored on a floppy disc is accessible to people that are trained on the computer and have access to the floppy disc. This thesis stored on a file server connected to the Internet is accessible to people that are trained on the computer and have access to the Internet. A person who is visually impaired can download the entire text of this document from the Internet, and use a screen reader to gain access to the words. More information is available to the employee that can use a computer and has access the Internet.

Telephone relay services accommodate people who are unable to communicate verbally. Closed-captioning provides services for viewers unable to hear the television. The Technology-Related Assistance for Individuals with Disabilities Act recognizes the potential of modern technology to improve the lives people with disabilities socially, at home, school, and at work. A majority of the 49 million Americans with a recognized disability are capable, without assistance, to various degrees of using the telephone, listening to the television, reading a book or newspaper, and using a computer at work and at home. Employers that

provide reasonable accommodations and invest in the education and training employees will benefit from the increased productivity of their employees.

"While 59 percent of California workers surveyed in the Field Poll said they believe that learning new skills was the only way to open the door to work-force advancement- or to find another job- only 39 percent said their employer provided skills training [Ref 19]."

The Internet is the fastest growing information exchange medium in the world. The Internet is used to exchange E-mail and files, have real-time collaborative work/discussion groups, conduct sales and other business ventures, distance learning, and tele-medicine. With 46 percent of Americans using computers at work and more than 25 percent having them at home, computers have become a way of meeting people to socialize, and a valuable tool for doing work. Communicating with E-mail is often quicker and cheaper than the U.S. Postal Service. The number of users that transmit voice conversations over the Internet with their PC is also growing. The Internet is available to do these things because it is unregulated, no one owns it, and anybody with a computer and a modem can easily subscribe to it.

The Internet and the advantages offered by it are also available to people with disabilities. People can choose to use a written form of communication, audio, or even audio with video. The hardware and software required for these mediums of communication via the Internet are available to users now. The Internet Service Providers in the future might offer a Personal Communication Service via the Internet competing with telephone companies.

Communications services for people with disabilities that are required by federal and state laws and regulations may soon become obsolete. Services such as the Federal Information Relay Service and the state operated Telephone Relay Service will survive in the long run only where they are subsidized. It would prove difficult and probably fruitless to try and write laws prescribing how future technologies will be used to assist the disabled. The most cost effective and efficient way is to write the laws and regulations requiring that "accessability" be designed into new products. For example, current law requires that all televisions be built with a V-chip and a closed captioning chip.

The Sixth International World Wide Web Conference is scheduled for April 7-12, 1997 in Santa Clara, California. The theme for this years conference is "AccessAbility." NPS should be ready to represent DoD at this conference. A request for input by all DoD education/training activities and system engineering commands could provide a wealth of ideas. Accessibility for everyone is worth the added extra effort! Additional information on the conference can be found on the web at (<http://www6conf.slac.stanford.edu/>).

Hopefully this thesis will be utilized by management as a guide. It highlights just some of the history of the American with Disabilities Act (ADA), my personal experiences, and my recommendation regarding organizations that may prove helpful in meeting the spirit of the ADA.

APPENDIX A. "ADA - NOT A DISABLING MANDATE"

The following article is quoted from the *The Wall Street Journal*, Wednesday, July 26, 1995. Written by *Attorney General Janet Reno* and *Mr. Dick Thornburgh*, who was attorney general in the Bush administration, [Ref. 8].

Today, America celebrates the fifth anniversary of the Americans with Disabilities Act, the ADA. It is a good time to step back and examine a record of substantial achievement. Already, barriers to the participation of people with disabilities are coming down - in grocery stores, restaurants, and hotels, in government buildings, banks and movie theaters.

In 1990, before the ADA became law, people with disabilities often could not get a job, ride a city bus, or go to a restaurant or store. These barriers imposed staggering costs on the country. In signing the ADA, President Bush estimated that each year federal, state and local governments spent almost \$200 billion to support people with disabilities.

When it passed the law, Congress found that an overwhelming majority of individuals with disabilities lived in isolation and dependence. And it recognized that when store owners or employers excluded people because of their disabilities, civil rights laws were simply inadequate to redress this discrimination.

Thanks to the ADA, this bleak picture is beginning to brighten. The nation's six million private business and 80,000 state and local governments are making their services accessible to disabled people.

To a great extent, these outstanding results are a testament to the approach the Justice Department - in both Republican and Democratic administration - has taken to enforce the ADA. Our top priority has been to encourage voluntary compliance. We have geared the department's efforts toward education - providing technical assistance and information to help businesses and local governments comply with the act in easy, cost-effective ways. We have turned away from fringe issues and focused on the core principles of the act: equal access to goods and services that are necessary to daily life. And we have sought to use the ADA's enforcement tools - litigation and civil penalties - only as a resort against those who thumb their noses at the law.

Readers of this page frequently hear a different story about the ADA. Although a recent Harris poll, commissioned by the National Organization on Disability, found that the overwhelming majority of business leaders support the act, some journalistic naysayers have charged that the law imposes

unreasonable burdens. They mischaracterize the ADA by implying that it requires businesses to spend outrageous sums removing barriers almost overnight.

These criticisms miss the mark. The ADA's requirements provide flexibility to business and government. The ADA strikes a carefully calibrated balance between the rights of people with disabilities and the legitimate concerns of business and government, including cost. It merely codifies common sense.

For example, business must remove architectural barriers in existing facilities only when this goal is "readily achievable," that is, only when it can be done "without much difficulty or expense." What may not be readily achievable for a small business this year may well be achievable if profits improve next year. And the ADA encourages low-cost ways to solve a problem. Restaurants do not have to provide menus in braille; waiters can read them to blind customers. A business located on the second floor of an older building need not install an elevator; it would be enough to offer curbside service to customers with disabilities.

Critics also charge that the ADA requires extensive renovation of all state and local government buildings. Again, they don't understand the law. The ADA requires all government programs, not government buildings, to be accessible. Local governments need not do anything that would result in an undue financial burden. A town library, for example, need not provide elevators to reach upper floors, so long as librarians are available to retrieve books for patrons who use wheelchairs.

Finally, some claim that the ADA is harming businesses by subjecting them to lawsuits by people without real disabilities. But litigation under the act has been rare. The Justice Department and the Equal Employment Opportunity Commission, together, have averaged fewer than 25 suits during each of the past five years. A Justice Department review revealed about 650 ADA cases nationwide. Whether you compare these numbers to the total number of non-ADA cases in federal courts (about 850,000) or the number of employers covered by the act (about 650,000), one thing is clear: The ADA has not resulted in a flood of litigation.

Further, the ADA does not require employers to hire anyone who is not qualified for the job. An employee or job applicant may not succeed in claiming discrimination under the ADA unless he or she meets all of the requirements of the job and can perform its essential functions. The act simply demands that employers provide "reasonable accommodation" for otherwise qualified workers. Experience shows that most accommodations can be made without difficulty and at little or no cost. A recent study commissioned by Sears indicates that of 436 reasonable accommodations provided by the company, 69% cost nothing, 28% cost less than \$1,000 and only 3% cost more than \$1,000.

Most people in the business community understand that the ADA has been good for business; it has expanded the markets served by most establishments and opened the doors to productive people with disabilities, all at a minimal cost. We are committed to making the ADA's goals a reality, to give Americans with disabilities an equal chance to participate in all this nation has to offer.

APPENDIX B. THE FEDERAL INFORMATION RELAY SERVICE

The Federal Information Relay Service (FIRS) and the Telecommunication Relay Service (TSR) are federal and state operated telephone systems, respectively, [Ref. 20]. With the assistance of a third party, the operator, conversations can take place between two people where one is hearing or speech impaired. The following information is quoted in part from the FIRS web page.

Federal Information Relay Service (FIRS)

Web page: <http://www.gsa.gov/et/fic-firs/firs.htm>

The following information is compiled from the home page. The Telecommunications Accessibility Enhancement Act of 1988 tasks the General Services Administration (GSA) with assuring that the Federal Telecommunications System is fully accessible to individuals who are deaf, hard of hearing, or speech impaired. To carry out this responsibility the Federal Information Relay Service (FIRS) was established in 1989.

When to call the Federal Information Relay Service (FIRS):

1. If you use a Telecommunications Device for the Deaf (TDD/TTY) and need to reach a Federal agency or program that does not have a TDD/TTY.
2. If you are a Federal employee who uses a TDD/TTY and your job requires you to contact an office that does not have a TDD/TTY.
3. If you do not have a TDD/TTY but need to get in touch with a Federal employee who uses a TDD/TTY.

The Federal Information Relay Service (FIRS) can be reached at: 1-800-877-8339.

The Automated Federal TDD/TTY directory can be reached at: 1-800-877-8845.

Whenever you make a LOCAL call requiring the services of a Communications Assistant, even if it is for Federal government business, you should use your State relay rather than the Federal Information Relay Service (FIRS).

Telecommunication Relay Service (TSR)

Individual States are allowed to establish it's own Information Relay Service. The California Telecommunications Relay Service operates in a similar fashion as the Federal service. The California numbers are:

1-800-735-2929 (TTY/TDD Only)

1-800-735-2922 (Telephone Only)

Other State TSR telephone numbers can be obtained from the FIRS home page.

APPENDIX C. INTERNET RESOURCES ON DISABILITIES

A list of excellent Internet resources offering services and information. The descriptions after their Uniform Resource Locator (URL) are quoted from their home page.

ADA TEXT:

(<http://www.gsa.gov/coca/>) or (<http://janweb.icdi.wvu.edu/english/links/adalinks.htm>) The American with Disabilities Act of 1990 is provided on-line. January 1996.

ADA Document Center

(<http://janweb.icdi.wvu.edu/kinder/>) February 1996. This web page contains numerous links to other documents on disabilities related issues. This page is accessible form JAN's home page.

EASI:

(<http://www.isc.rit.edu/~easi/>) August 1996. "Equal Access to Software and Information" home page. The following information on the services provided is quoted. "EASI provides informative publications, including an electronic journal, Information Technology and Disabilities, on-site seminars and a series of e-mail delivered workshops to assist colleges, schools, businesses and libraries in making their information technology resources more accessible and in meeting the challenge of disability legislation."

(<gopher://SJUVM.stjohns.edu:70/00/disabled/easi/easipub/easilaw.adakit>) August 1996. "Adaptive Computing Evaluation Kit." EASI created this kit to give college and university campuses ideas and guidelines that will help them meet the needs of their students, faculty, and staff with disabilities and at the same time take a proactive approach to complying with the spirit and the letter of the ADA. This comprehensive kit also gives information and guidance that will help campuses conduct the computing component of the self-evaluation required by the ADA. Purchase of the kit entitles a campus to a half-hour of phone consultation with one of EASI's consultants.

FIRS

(<http://www.gsa.gov/et/fic-firs/firs.htm>) August 1996. For users of Telephone Device for the Deaf (TDD) the Federal Information Relay Service and the Telecommunication Relay Service can be an invaluable accommodation.

JAN

(<http://janweb.icdi.wvu.edu/>) June 1996. "The Job Accommodation Network" (JAN) is an

international toll-free consulting services that provides information about job accommodations and the employability of people with functional limitations.

Pursuit

(<http://primes6.rehab.uiuc.edu/pursuit/homepage.html>) July 1996. Here you will find a wealth of resources including: disability information, education accommodation resources, lessons on assistive technology and funding available for this technology, descriptions of careers in science, engineering, and mathematics, high school preparations for these careers, access to countless other disability information servers, and much more.

GSA, Center for Information Technology Accommodation

(<http://www.gsa.gov/coca/>) December 1995.

(<http://www.gsa.gov/coca/front.htm>) December 1995. "Managing Information for Accessibility" Developed by GSA, it is an excellent handbook for managers dealing with accessibility problems in the workplace.

(<http://www.gsa.gov/coca/WWWcode.htm>) June 1995 Draft. "Writing Accessible HTML Documents" Developed by the "Center for Information Technology Accommodation" a division of GSA. This web page provides a set of guidelines on how to design and code HTML documents so that the information is available to users with visual limitations or are blind.

Sixth International World Wide Web Conference

(<http://www6conf.slac.stanford.edu/>) August 1996. The main theme of the event is "AccessAbility." April 7-12, 1997: Santa Clara, CA.

APPENDIX D. EQUAL ACCESS TO SOFTWARE AND INFORMATION

The following information is quoted in part from Project Equal Access to Software and Information (EASI), by Norman Coombs and G. Phillip Cartwright. Change Magazine, March/April 1994. pp 42-44. This information is also available on the following web page; "<http://www.rit.edu/~easi>", 26 August 1996. [Ref 21]

Project EASI is dedicated to assisting higher education in developing computer support services for people with disabilities. EASI is extending its outreach to faculty through its new collaboration with the American Association for Higher Education (AAHE). EASI provides information and guidance on campus applications of adaptive computer technology, including access to information resources, instruction, research, and employment. Its membership includes professionals from the United States, Canada, and other countries.

Project EASI offers several resources to help colleges and universities meet the requirements of the ADA and simultaneously provide high-quality education for students with disabilities.

A. Seminar Series. The EASI Seminar Series is a multi-unit workshop package that offers strategies for developing and enhancing adaptive computer technology services. The workshops address legal issues, demographics, computer access strategies, compensatory computer strategies, accessible lab environments, and many of the other service, delivery, integration, and transitional issues that are critical for today's college and university campuses. They target a variety of audiences, with certain modules specifically designed for computer-services providers, college and university faculty, staff members, and campus administrators.

B. Adaptive Computing Evaluation Kit. EASI created this kit to give college and

university campuses ideas and guidelines that will help them meet the needs of their students, faculty, and staff with disabilities and at the same time take a proactive approach to complying with the spirit and the letter of the ADA. This comprehensive kit also gives information and guidance that will help campuses conduct the computing component of the self-evaluation required by the ADA. Purchase of the kit entitles a campus to a half-hour of phone consultation with one of EASI's consultants.

The kit can be viewed at,

"<gopher://SJUVM.stjohns.edu:70/00/disabled/easi/easipub/easilaw.adakit>" without charge.

A reasonable licensing fee is required if any portion of the checklist is to be implemented.

C. On-line Workshops. With the help of the Rochester Institute of Technology, EASI volunteers provide some of the seminar materials described earlier as an on-line workshop. These on-line workshops are offered for a fee via E-mail making access to them very wide and easy to complete. For a current syllabus on workshops being offered and enrollment fees, send e-mail to:

listserver@listserv.isc.rit.edu

with this one line of text:

info workshop .

APPENDIX E: INTERNET RESOURCES FOR EMPLOYMENT OF THE DISABLED

A. The Job Accommodation Network

The following information is quoted from the Job Accommodation Network's home page, (<http://janweb.icdi.wvu.edu/>), June 1996. The Job Accommodation Network (JAN) is an international toll-free consulting services that provides information about job accommodations and the employability of people with functional limitations.

Anyone may call JAN for information. Calls are answered by consultants who understand the functional limitations associated with disabilities and who have instant access to the most comprehensive and up-to-date information about accommodation methods, devices and strategies. JAN preserves the confidentiality of communication between caller and consultant.

The mission of JAN is to assist in the hiring, retraining, retention or advancement of persons with disabilities by providing accommodation information.

JAN's work helps:

Employers

- hire, retain, and promote qualified employees with disabilities;
- reduce worker's compensation and other insurance costs;
- address issues pertaining to accessibility;
- provide accommodation options and practical solutions;

Rehabilitation Professionals

- facilitate placement of clients through accommodation assistance;

- find local resources for workplace assessment;
- discover resources for device fabrication and modification;

Persons with Disabilities

- acquire accommodation information;
- discover other organizations, support groups, government agencies, and placement agencies.

Toll Free Information Services

Calls are answered from 8 a.m. to 8 p.m. Eastern Time Monday through Thursday, and on Fridays from 8-5. Machines answer after-hours calls.

Accommodation Information, Voice/TDD 1-800-526-7234

ADA Information, Voice/TDD 1-800-232-9675

E-mail jan@jan.icdi.wvu.edu

Postal Service: Job Accommodation Network
P.O. Box 6080
Morgantown, West Virginia 26506-
6080

B. Project Hired

The following is from an information packet obtained from:

Project HIRED/ HIRED TEMPS
P.O. Box 3453 M/S 31
Sunnyvale, CA. 94088
Voice/TDD: (408) 730-0880
E-mail: prohired@ix.netcom.com

Project HIRED is a private not-for-profit organization that offers disability related

services to individuals with disabilities and employers in the Silicon Valley. Their services are identified as being:

- Pre-employment services and referrals.
- Corporate training partners project. Training is offered by members of the partners to qualified applicants which will upgrade their skills strategically for today's market.
- Hire Temps. A temporary job service in the San Francisco Bay Area.
- Corporate services. Consulting services, on-site seminars, and support services for employers on issues related to disabilities in the workplace.

C. The National Clearinghouse of Rehabilitation Training Materials

The following information is quoted in part from information received from the National Clearinghouse of Rehabilitation Training Materials (NCRTM). They are located on the Internet at; (<http://www.nchrtm.okstate.edu>).

The Oklahoma State University sponsors the NCRTM. It provides information to rehabilitation professionals and others using the following publications and services:

- NCHRTM Memo
- Special Interest Catalogs
- On-line BBS with catalog database
- Featured Training Materials Catalog

The NCHRTM Memo contains information about rehabilitation resources that have been submitted to the NCHRTM since the previous Memo. Catalogs contain

international materials, counselor training curriculum, interpreter education videotapes, computer disks, audio tapes, other video tapes, and special education resources.

Requests for information are received by phone, FAX, mail, and on the Bulletin Board. Training materials are distributed on a cost recovery basis for duplicated materials or on a 30 day loan basis for reference materials.

NCHRTM
Oklahoma State University
816 W. 6th Avenue
Stillwater, OK 74078
Phone: 1-800-223-5219 or
405-624-7650
FAX: 405-624-0695
BBS: 405-624-3156

APPENDIX F. COMMUNICATING WITH AND ABOUT PEOPLE WITH DISABILITIES

This information is copied directly from the Job Accommodation Network (JAN) located on the WWW, [Ref. 22]. The information for this fact sheet came from three sources: The President's Committee on Employment of People with Disabilities, Guidelines to Reporting and Writing About People with Disabilities, produced by the Media Project, Research and Training Center on Independent Living, 4089 Dole, University of Kansas, Lawrence, KS 66045, and Ten Commandments of Etiquette for Communicating with People with Disabilities, National Center for Access Unlimited, 155 North Wacker Drive, Suite 315, Chicago, IL 60606.

The Americans with Disabilities Act (ADA), other legislation, and the efforts of many disability organizations have begun to improve accessibility in building, increase access to education, open employment opportunities, and develop realistic portrayals of persons with disabilities in television programming and motion pictures. However, more progress needs to be made. Many people still view persons with disabilities as individuals to be pities, feared, or ignored. These attitudes may arise from discomfort with individuals who are perceived to be different or simply from a lack of information. Listed below are some suggestions on how to relate and communicate with and about people with disabilities. We must look beyond the disability and look at the individual's ability and capability-- the things that make each of us unique and worthwhile.

Words

Positive language empowers. When writing of speaking about people with disabilities, it is important to put the person first. Group designation such as “the blind,” “the deaf” or “the disabled” are inappropriate because they do not reflect the individuality, equality, or dignity of people with disabilities. Following are examples of positive and negative phrases. Note that the positive phrases put the person first.

AFFIRMATIVE PHRASES	 NEGATIVE PHRASES
- person with mental retardation	retarded, mentally defective
- person who is blind, person who is visually impaired	the blind
- person with a disability	the disabled, handicapped
- person who is deaf, person who is hard of hearing	suffers a hearing loss, the deaf
- person who has multiple sclerosis	afflicted by MS
- person with cerebral palsy	CP victim
- person with epilepsy, person with seizure disorder	epileptic
- person who uses a wheelchair	confined or restricted to a wheelchair
- person who has muscular dystrophy	stricken by MD
- physically disabled	crippled, lame, deformed
- person without a disability	normal person (implies that the person with a disability isn't normal)

- unable to speak, uses synthetic speech	dumb, mute
- seizure	fit
- successful, productive	has overcome his/her disability; courageous (when it implies the person has courage because of having a disability)
- person with psychiatric disability	crazy, nuts
- person who no longer lives in an institution	the deinstitutionalized
- says she/he has a disability	admits she has a disability

Actions

Outlined below are the “Ten Commandments of Etiquette for Communicating with People with Disabilities” to help you in communicating with persons with disabilities.

1. When talking with a person with a disability, speak directly to that person rather than through a companion or sign language interpreter.
2. When introduced to a person with a disability, it is appropriate to offer to shake hands. People with limited hand use or who wear an artificial limb can usually shake hands. (Shaking hands with the left hand is an acceptable greeting.)
3. When meeting a person who is visually impaired, always identify yourself and others who may be with you. When conversing in a group, remember to identify the person to whom you are speaking.
4. If you offer assistance, wait until the offer is accepted. Then listen to or ask for instructions.

5. Treat adults as adults. Address people who have disabilities by their first names only when extending the same familiarity to all others. (Never patronize people who use wheelchairs by patting them on the head or shoulder.)

6. Leaning on or hanging on to a person's wheelchair is similar to leaning on hanging on to a person and is generally considered annoying. The chair is part of the personal body space of the person who uses it.

7. Listen attentively when you're talking with a person who has difficulty speaking. Be patient and wait for the person to finish, rather than correcting of speaking for the person. If necessary, ask short questions that require short answers, a nod or shake of the head. Never pretend to understand if you are having difficulty doing so. Instead, repeat what you understood and allow the person to respond. The response will clue you in and guide your understanding.

8. When speaking with a person who uses a wheelchair or a person who uses crutches, place yourself at eye level in front of the person to facilitate the conversation.

9. To get the attention of a person who is deaf, tap the person on the shoulder or wave your hand. Look directly at the person and speak clearly, slowly, and expressively to determine if the person can read your lips. For those who do lip read, be sensitive to their needs by placing yourself so that you face the light source and keep hands, cigarettes and food away from your mouth when speaking.

10. Relax. Don't be embarrassed if you happen to use accepted, common expressions such as "See you later," or "Did you hear about that?" that seems to relate to a person's disability. Don't be afraid to ask questions when you're unsure of what to do.

APPENDIX G. COMPUTER/ELECTRONIC ACCOMMODATIONS PROGRAM

In October of 1990 established the Computer/ Electronic Accommodations Program (CAP) to provide assistance to DoD activities in obtaining appropriate accommodations for employees with disabilities. The following is a brief description of CAP's services. The following information is condensed directly from CAP's Information Package that can be obtained by request from:

CAP Office
Defense Medical Information Management
5111 Leesburg Pike, Suite 810
Falls Church, VA. 22041-3206
Phone Comm.: (Voice/TTY) 703-681-8811
DDN 761-8812
E-mail cap@ha.osd.mil

CAP's services make DoD work environments more accessible to DoD employees with visual, hearing, dexterity, and cognitive impairments by:

- Buying accommodations to make computer and telecommunications systems accessible to employees with disabilities.
- Funding sign language interpreters, readers, and personal assistants for employees attending long-term training (two days or more).
- Providing expertise in solving accessibility problems through the use of software, hardware, and other adaptive technology.
- Providing training and educational support.

Centrally located in the Pentagon, is CAP's Technology Evaluation Center (CAPTEC). The center contains several computer workstations equipped with a wide variety of equipment designed to accommodate persons with disabilities.

CAPTEC's mission is to facilitate the process of choosing adaptive equipment for people with disabilities. People seeking solutions to access problems can visit CAPTEC to see the type of equipment that is available, compare different solutions, and ensure that adaptive equipment will be compatible with their current automated environment.

APPENDIX H. "MISS AMERICA FLIES IN F-16"

This article appeared in *Code One*, April 1996, [Ref. 23]. (<http://www.lmtas.com>)

Miss America 1995 Heather Whitestone got the ride of her life in an F-16 at the 178th Fighter Wing in Springfield , Ohio, last November. Whitestone, who is profoundly deaf, wore a special hearing-enhanced helmet developed at USAF's Armstrong Laboratories and successfully tested earlier in 1995. The helmet electronically lowers undesirable background noise with a technique called active noise reduction. While the technology was developed to help pilots hear better and to protect their ears, it has several civilian application as well. Whitestone was the keystone speaker at a Wright-Patterson event designed to draw attention to technology-transfer efforts relating to people with disabilities.

APPENDIX I. "WINE LABELS IN BRAILLE COULD BOOST SALES TO BLIND CONSUMERS"

This article by Teri Shore appeared in the *Wine Business Monthly*, February 1996, [Ref 24]. Available on, <http://smartwine.com>.

Vintners might sell more wine to the nation's 5 million blind consumers if labels and wine lists were printed in Braille, the alphabet comprised of raised dot patterns that is read with the fingers.

Ramona Ferguson, who has transcribed and produced Braille menus for several large hotel restaurants and is now offering her services to the wine industry, said that wineries currently ignore the blind market.

"I find it degrading and absentminded of wine producers not to include the blind in their business, while treating them as customers," said Ferguson, who is visually impaired. "It has been proven that a blind customer will go to an establishment where there is a Braille menu to read."

About 20 percent of the blind population could be potential wine buyers, Ferguson estimated, though she said that no marketing studies have examined this market. About 150,000 blind people live in California alone, she estimated, of which about 30,000 are possible wine drinkers.

In recent years both the Stouffer Dallas Hotel and the Westin Maui have printed their menus in Braille, and recorded growth among blind customers, she said.

Robert Mondavi Winery may be the first to test the market by putting Braille labels on a limited number of wine bottles.

"We are considering it," said Harvey Posert, winery spokesman. "It's a very good idea."

The winery has not yet evaluated exactly how the braille labels would appear or be attached to bottles. Posert said they might work best as neckers. Retailers may also be able to use them as shelf talkers, he added.

The label samples provided by Ferguson were simple white rectangles embossed with the white dot patterns. It's still unclear how wineries would use the Braille labels and how big a market there really is, according to wine industry sources. The labels sell for 20 cents each and require a two-week processing period.

For more information, contact Ferguson, PO Box 123, Compton, CA 90223, 310-515-3434.

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